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Quantification Tools for Analyzing Tomograms of Energy Materials

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The structure of materials used in the energy sector, such as catalysts, CO2 and hydrogen storage materials or fiber composites is intrinsically heterogeneous. The efficiency and lifetime of devices depends critically on the details of the materials' 3D microstructure and the relation between such structures. Recently developed X-ray imaging techniques provide a resolution that allows for seeing inside a device without destroying it.

There are a number of analysis tasks that need to be carried out in order to harvest the benefits from state of the art X-ray imaging techniques.
This includes image segmentation of the reconstructed volumes. By segmenting structures we are able to measure size and shape and quantify important structures. Examples include pores and interface distributions in a catalyst, or glass fiber size, shape and length distributions in a wind turbine blade.

We have a method that, based on a manually annotated training image, can learn local image patterns. These patterns are used to separate image structures that do not deviate in average image intensity but only in the local image structure. Using this method we can precisely solve segmentation problems, e.g. separating detailed structures like fibers, which would not be possible with traditional segmentation methods. The segmentation and analysis tools we develop in this project will be central in solving problems for predicting flow or damage in energy materials.